Post-Mortem for a Portable Re-charging Battery Pack (D-Charger)

Company name: Discovery Technologies

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Glossary

AC - Alternating Current
DC - Direct Current
NiCd - nickel - cadmium
NiMH - nickel metal hydride
Li - lithium
USB - Universal Serial Port

1. INTRODUCTION

The D-Charger battery pack is a self-generating electricity device, with three charging modules: solar panel, hand cranking, and feed pedal modules. Since electricity is an important component for many of our devices, we were motivated to create a portable source of power for any time or environment.

The D-Charger battery pack gets power from sun light, hand crank, and walking without requiring AC power source, making D-Charger is a good solution as a backup power source. Meaning the device is a helpful alternative for people where steady electricity is not readily accessible. Therefore places such as Africa or some poor conditional places in China that do not have electricity can benefit from our device. The constant green power generated from D-Charge is an additional motivation for this project.

2. SYSTEM OVERVIEW

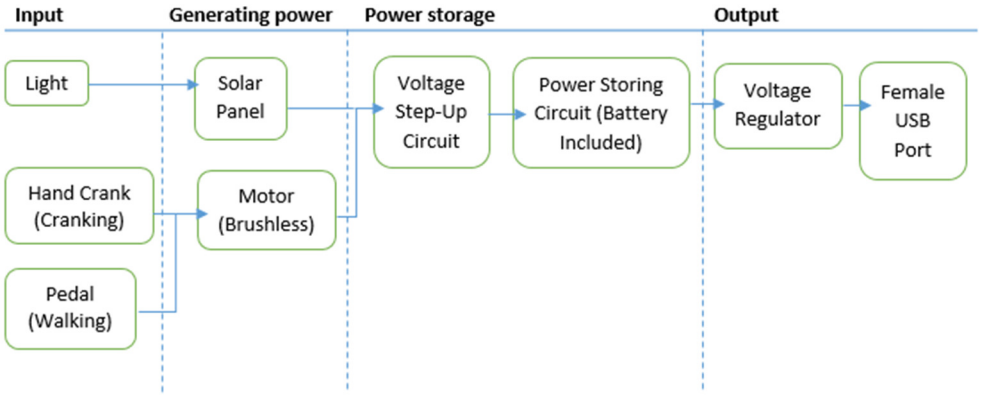


FIGURE 1: SYSTEM OVERVIEW

There are three functions for our D-Charger which is hand cranking, feet petal, and solar panel. As showing in the Figure 1, we use light, hand cranking and walking as our input. For cranking and walking, we convert the mechanical energy into electrical energy using a motor, and solar energy into electrical energy using a solar panel. Lastly the, energy will be stored in the batteries and exported through a female USB port.

2.1 Hand Crank and Solar Panel Module

The hand crank module is our main module which contains the electrical circuitry with the brushless motor, switch for outputting power and the connection to the solar panel. This can be seen in Figure 2, where the LED of the PCB will light up when power is generated. Also when

the switch is pressed and the circuit is able to output energy to the connected device, using the energy in the batteries.

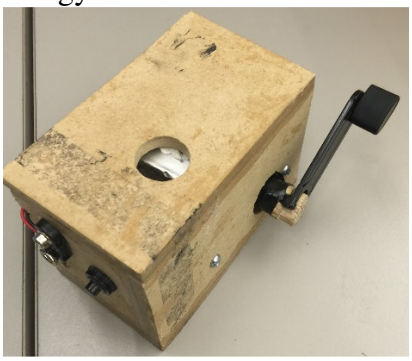


FIGURE 2: HAND CRANK MODULE

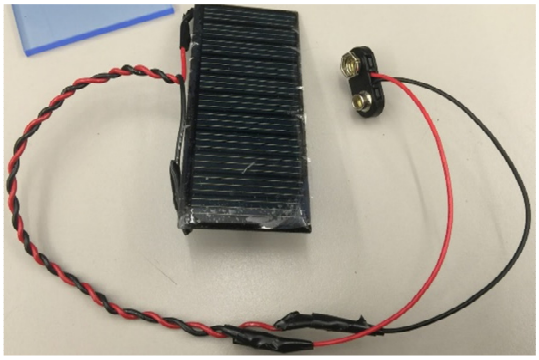


FIGURE 3: SOLAR PANEL

For the solar panel we attached a square battery connector for linking hand crank module's connector, seen in Figure 3. Both of the modules are tested to work, since the LED light up.

2.2 Feet Pedal Module

We have built feet pedal module system to utilize a pressing mechanism, to transfer each step taken into electricity. However the feet pedal does not provide enough torque to turn the hand crank's gears. Users can easily attach the D-Charger to their shoes, using the shoelaces on the module, to strap it onto their shoes. With the connector between the modules was finished, supposedly each step will turn the motor to generate energy.

2.3 Electrical Overview

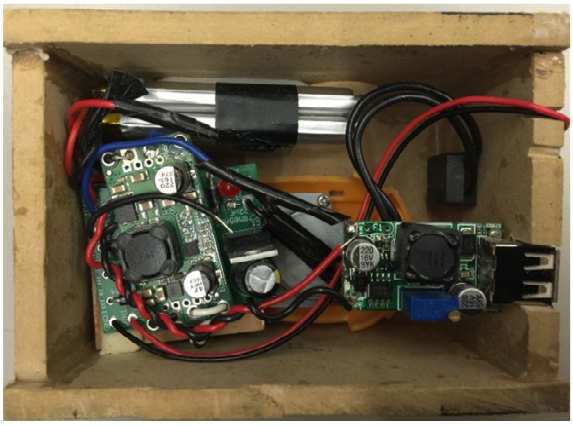


FIGURE 4: ELECTRICAL CIRCUIT IN THE HAND CRANK MODULE

For the electrical component we were able to test and see that when charging the LED lights up, and when the button is pressed to allow charging of devices the LED on the USB component

lights up. We also tested and confirmed that we can charge the device, Davidson's Iphone, causing the device to show that it is charging.

3. FINANCE

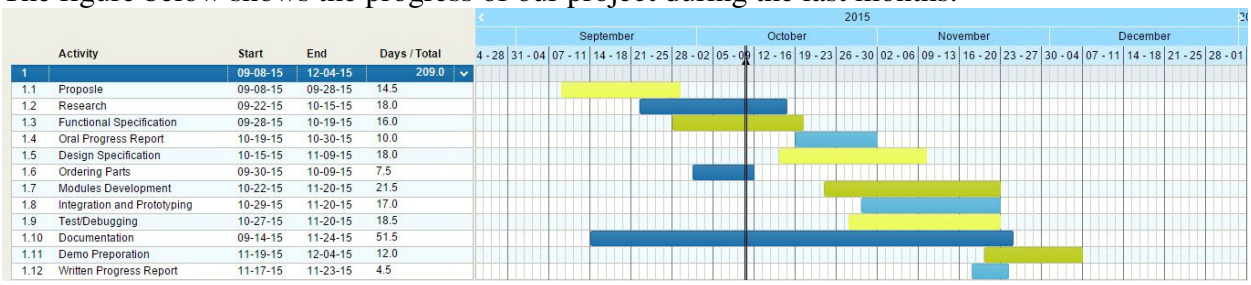
TABLE 1: OUR ESTIMATED AND ACTUAL BUDGET

original components cost	Estimate cost	Final component list	Final cost
solar panel*3	$100	solar panel *1	$6.8
Rechargeable battery*2	$120	Li-ion batteries*2	$40
wires	$10	Electrical components	$82.23
pedal electricity generator	$120	pedal flashlight	$44.91
Hand cranking electricity generator*3	$50	Hand cranking flash lighting*2	$29.9
		PCB*3	$295
		Mechanical/ Case materials	$100.92
TOTAL	$400		$ 603.76

As you can see in the table above, our estimated expenses and our final expenses.

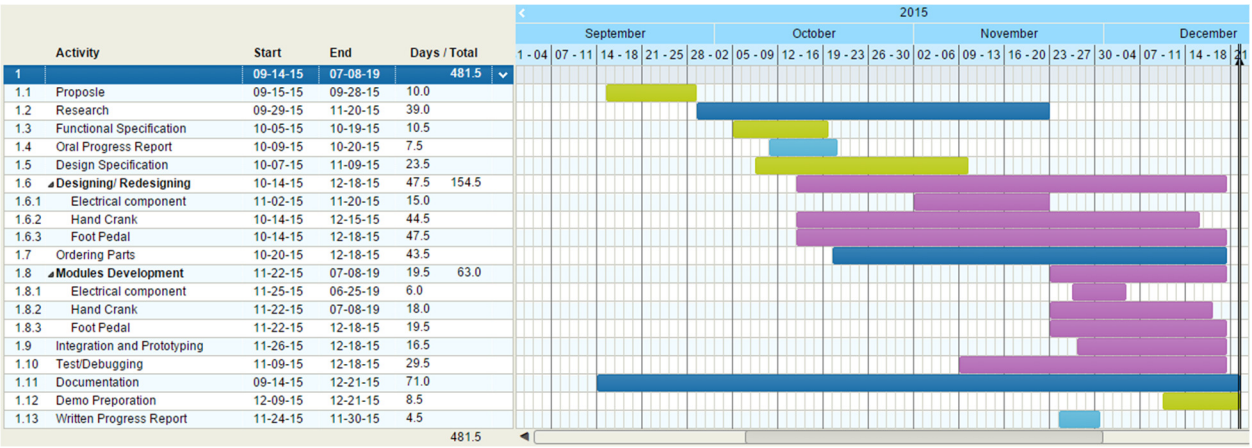
4. TIMELINE

The figure below shows the progress of our project during the last months:



	Activity	Start	End	Days / Total
1		09-08-15	12-04-15	209.0
1.1	Proposle	09-08-15	09-28-15	14.5
1.2	Research	09-22-15	10-15-15	18.0
1.3	Functional Specification	09-28-15	10-19-15	16.0
1.4	Oral Progress Report	10-19-15	10-30-15	10.0
1.5	Design Specification	10-15-15	11-09-15	18.0
1.6	Ordering Parts	09-30-15	10-09-15	7.5
1.7	Modules Development	10-22-15	11-20-15	21.5
1.8	Integration and Prototyping	10-29-15	11-20-15	17.0
1.9	Test/Debugging	10-27-15	11-20-15	18.5
1.10	Documentation	09-14-15	11-24-15	51.5
1.11	Demo Preporation	11-19-15	12-04-15	12.0
1.12	Written Progress Report	11-17-15	11-23-15	4.5

FIGURE 5: ORIGINAL ESTIMATED SCHEDULE



	Activity	Start	End	Days / Total	
1		09-14-15	07-08-19	481.5	
1.1	Proposle	09-15-15	09-28-15	10.0	
1.2	Research	09-29-15	11-20-15	39.0	
1.3	Functional Specification	10-05-15	10-19-15	10.5	
1.4	Oral Progress Report	10-09-15	10-20-15	7.5	
1.5	Design Specification	10-07-15	11-09-15	23.5	
1.6	Designing/ Redesigning	10-14-15	12-18-15	47.5	154.5
1.6.1	Electrical component	11-02-15	11-20-15	15.0	
1.6.2	Hand Crank	10-14-15	12-15-15	44.5	
1.6.3	Foot Pedal	10-14-15	12-18-15	47.5	
1.7	Ordering Parts	10-20-15	12-18-15	43.5	
1.8	Modules Development	11-22-15	07-08-19	19.5	63.0
1.8.1	Electrical component	11-25-15	06-25-19	6.0	
1.8.2	Hand Crank	11-22-15	07-08-19	18.0	
1.8.3	Foot Pedal	11-22-15	12-18-15	19.5	
1.9	Integration and Prototyping	11-26-15	12-18-15	16.5	
1.10	Test/Debugging	11-09-15	12-18-15	29.5	
1.11	Documentation	09-14-15	12-21-15	71.0	
1.12	Demo Preporation	12-09-15	12-21-15	8.5	
1.13	Written Progress Report	11-24-15	11-30-15	4.5	
				481.5	

FIGURE 6: ACTUAL SCHEDUAL

The first gantt chart illustrates the original estimated schedule, while the second one represents the real schedule, showing the differences between our plan and the real progress. Due to unexpected amount of time needed to research parts and standards, as well as unexpected mechanical problems our whole progress were delayed.
We should do more research at the beginning of the project and give more set more time incase of unexpected problems. By doing this we can ensure we have enough time to face the emerging problems.

5. Future Plans

- Size
  Because we do not have enough mechanical experience, when we integrate the whole system, the height of the feet pedal part is not as small as we desired. For future changes we can alter the gears used, or change their arrangement to decrease the feet pedal module's height.

- Structure
  For the shape our modules, we plan to improve its aesthetics as well as making the feet pedal size adjustable for different feet sizes.

- Material
  Due to the lack of means, the material we have been use right now is the wood. For the future, we want to use 3D printer to make our hand crank case and light but strong material for making the feet pedal

6. Challenges and Modification

6.1 Hand Crank

Originally we designed our electrical circuit with a 4 diode rectifier, however since we used a brushless motor (with 3 phase wavelengths), we need a 6 diode rectifier design. Also we removed the AC output outlet component due to a recommendation of a TA. Due to the thickness of the wood, we had to alter the hand crank bar to reach the gears.

6.2 Feet Pedal

The original problem we encountered was for finding a method of connecting the feet pedal module with the hand crank module's gears. We used the connector part of the hand crank rod, and using a plastic tube to connect the module. However another problem came up right afterwards is the lack in torque to turn the gears in the hand crank module. We were able to alter the feet pedal to provide more force, however it can only turn the gears if operated slowly, which does not fit the specification of the module.

6.3 Solar Panel

We originally thought of permanently connecting the solar panel to the PCB board, however we were warned that it might damage the solar panel. Therefore we use square battery connector to connect between solar panel.

7. Individual Reflection

7.1 Group Dynamics

In each stage of the project, every team member contributed their ideas. All group members contributed their efforts to the area they are good at. Davidson is our CEO who did great job and contribute almost in every part of the project. Moreover, as the only English first language speaker in our group, Davidson also response for all the documents final editing and grammar checking. In general, everybody put their efforts in this project which created a friendly work environment.

The main problem we faced in our team was not having enough time to work together. Due to academic pressure from other classes, it was difficult to find time where everyone can come and work on the project together. To counter this problem we held 3 regular meeting times every week to discuss what need to be done, what is done, and idea sharing; also for some meetings we relied on Skype. There was more time working together after classes ended and after exams, which allowing us to increase our speed on the project. Overall we feel that the group dynamics were relatively fine, and each member was able to work together well.

7.2 Davidson Kao – CEO

As a computer engineer student I felt that a large part of my expertise was could not be used in this project, which did not have a software component to it. However I was able to contribute many ideas and concerns into the design and development of the D-charger. Thus allowing me to have a better understanding and view on the project as a whole.

As the CEO of this group I was tasked with managing the other members of the group and giving out tasks. I found that I am not suited for this role due to my personality, for not being strict and demanding enough. Therefore, I see myself as the reason for the group not being able to follow the original schedule, due to my inability to give out tasks efficiently and being strict enough on the deadlines. Also I found that communication between group members are very important, especially when misunderstanding about some portions of the design slows down the development speed. This I also viewed as one of my mistakes early on as I had the broader view, due to working in many parts of the design. I found I would progress in designing without mentioning the ideas, or miscommunication the ideas to the other members. After this issue was discovered I made sure to mention my ideas, and check that they understood it completely before moving on.

Although bringing a computer engineer I ended up as the main contributor in the design of the electrical design. In which I was in charge of the development of the circuit and the PCB board design. In the process of designing the circuit took more work than required due to the insufficient research done, causing multiple iteration and design of the circuit. Also there was a lot of work in using the PCB designing tool Eagle, which required searching up specific electrical components and looking for their online libraries. In the case where the component libraries cannot be found, I was required to create the component library myself using the dimensions mentioned in the datasheets.

In the mechanical design of the project I felt that it was a lot harder than expected, due to the fact that none of the members are mechanical engineers. Also the design that I had envisioned at the start of the project was not a doable in the timespan given, especially since we were not able to develop such an advanced version with the tools we had.

All in all, I consider this a great learning experience, and an opportunity for preparing for the next time I am in such a situation.

7.3 Chao Duan – CTO

As a third year electronics engineering student in SFU, Capstone is the most challenging class compared with other courses. Through D-charger project, I have gained a lot of experience in applying theoretical knowledge about electrical design and mechanical connection design into practice. Meanwhile, I recognize teamwork skills in a fast pace environment is very important.

I am the CTO of our group, so I was responsible for research about the challenging problems that we met. In the beginning of the project, I did some research about the entire circuit of feet pedal function and PCB design. Based on my previous knowledge, I recognize the circuit that the motor generate is AC, however to charge the batteries we need DC. Therefore we need a rectifier circuit to convert AC to DC. Also I later studied Eagle to prepare for designing the PCB.

For the mechanical part, material searching and purchasing is an important part in our project because all of our group members are third year students without co-op experience, we do not have experience in 3D printing experience. Furthermore, the gears connection between the feet pedal and the hand crank, is a big problem. It was hard to find the matched plastic tube to connect two parts. After a lot of researching, we decided to use plastic tube instead of plexiglass.

Yufan and I went to Homedepot to find the case material for our feet petal function, where we compared several woods and plastic, and decided to use the medium density Fibreboard as our case material. We chose this material because it is strong enough to support the user's weight and price was under then out planed budget for it.

Overall, ENSC 305/440 is a valuable courses, where I have improved my researching skills and the problem solving skills.

7.4 Chuan Jiang – COO

At the beginning of this semester, I didn't know ENSC305/440 would be so difficult. During this time, I learned a lot about the application of electronics and mechanical components and improved my designing skill. But the most important thing that I learned is to professionally plan our whole project, at the beginning, and organize the team well using good communication skill.

I am a fourth year electronic engineering student, without co-op experience, so I did not realize the challenges of creating a real product. Before this project, I only knew a lot of basic theoretic concepts and did not them in designing a device. In the middle of this term, I found that when we are working on our projects, I needed to consider more things than I originally thought. So it became more difficult for us to keep our progress on schedule.

As the COO of D-Charger, I am mainly responsible for research, organization, structure design and assist other members. Based on my research, I gave several suggestions to our project topic, and the charging circuit with solar panel part is finally decided to be the project by my partners. They also added a generator to support two other ways of charging for D-Charger. For our designing part, I mainly finished the two cases structure design for our feet pedal part and generator part with accurate data. I also remembered the theory of voltage boost up/down circuit, and then I found some voltage regulator (boots up/down) with different input voltage ranges on

eBay and offered these information to our CEO to decide which one we should use. For the cases design part, I made a three views drawing for our two cases include the inner structure. During this process, I made a great improvement to our design, which is to connect the generator case from the left side of the feet pedal part instead of put it on the top; and put the feet petal gears vertically instead of horizontally to simplify the mechanical design of our product. For the link part between generator and feet pedal, it is really hard for us to solve this problem because we need to build a same size connector or a clutch, but I realized that we can cut the connector from the hand crank part and glue on the feet pedal gears.

I also learned some useful skills like soldering on the PCB board and some knowledge about using eagle. I successfully soldered components to the PCB board and it can worked well.

Before I took these courses, I usually do not go to find professors or TA for help, but now I find that they are really helpful. I talked with them many times and received many great ideas for solving the problems.

7.5 Kefan Gao – CIO

The engineering project course is the most practical course in the entire undergraduate engineering courses in SFU. It allows us to use what we have learnt in the past few year and turns theoretical knowledge into practical use. This course not only gives our team an impression of starting a start-up engineering company, but also helped us in improving interpersonal skill such as time management, teamwork and utilizing specialists in a company to achieve a common goal.

I gained invaluable experience in working in the team. Our team had to overcome differences of opinions and challenges, and this helped me learn the value of communication and importance of teamwork. Our project is able to produce a portable battery pack which gives us a few challenging problems such as PCB board and the connection between the 2 modules. I feel lucky to be in this team because each one has different skills and that helps a lot in our project process.

My contribution to our team was researching (on charging circuit design, electronic components, and structure design), testing circuit and cases structure design and production. Our project is about charging a portable battery and recharge a small electric device such as cell phone with our battery. During this project, we need to find out how to charge a battery and how the battery can charge a cell phone. I did some research on the charging circuit and provide some ideas to my team, and also I did some research on the battery to help my team find the suitable battery that we can use. Moreover, I design the inner and outer cases and used SKETCHUP to present my idea and discuss with my team members who give me several ideas to help me improve structure design. During the structure design, the major issue we have been facing is how to connect between hand crank and feed pedal gears. My initial idea is to use some parts from LEGO.

However, after some material research, I cannot find the suitable part that can handle the job. After all, my team decided to get some help from TA and he gives us a great idea about using tube as between and we got some inspiration to solve the problem.

Working with my team on designing circuit and structure was a great learning experience. Soldering diode and capacitor on the PCB helped me enhance precision with a solder.

7.6 Yufan.Wang(CFO)

For the past three month, I have put my efforts with my group members to construct the D-Charger. In this project, we have mostly completed the three main goals of our D-Charger, which is solar panel charging and hand crank charging, and with the feet pedal part incomplete. Through the study and research I did in this semester, I gained knowledge and skills that I did not learn before. As an electronic engineering student, the practical electronic circuit design and testing give me the sense of the charm of electronic engineering.

From the technical perspective, I mainly focus on three parts of our project, which is electronic components research, electronic circuit design and the circuit testing. Electronic components research is an important part, for the electrical part design. From the D-charger model design, we knew that we needed a solar panel, but we did not know what size, voltage, and efficiency of solar panel, we need is in the market. The original plan I made is use a battery from a portable charger battery which is 20100mAh, but we ended up selecting a li-on battery. The reason I choose to use the li-on battery is it has a high charge density which means a small volume of battery with a high capacity, and the portable charger battery is too big. So I researched and found a li-on battery which is the LP803860, where the shape of those battery is like an old cell phone battery. Another key point to choose the battery is, we needed to compare the input voltage of battery and the output voltage of our generator, otherwise the battery cannot charge. However, our output voltage is smaller than charging input voltage, so group members and I decide to use a voltage step-up regulator in the circuit to increase the output voltage. The battery we finally choose is only 2000mAh each and we connect two batteries in series to increase the voltage. For the solar panel, I searched online and found Lee Electronic store may have the solar panel we want. For the circuit design, we design the generating circuit by using several diodes to convert AC to DC. After we get our PCB board from factory, group members and I tested the circuit and hand cranking generator and solar panel. From the results, they all work.

Except search material and components online, I went to actual stores like Home Depot and Ikea several times in Burnaby and Coquitlam to search the feed pedal case material and board fixation material. Through online research and inside store search, Chao and I found that a man made wood board which is very hard but thin. Moreover, I found a tool to fix two board together which can replace the uses of glue to stick our boards together. All the materials we use is off-shelf material and we continue process them to what we want.

Through the process of our project, I found our working speed is serious slow since everyone is busy making us behind schedule. Therefore, at the middle of November, I made a new schedule we for the rest of semester with details and goals in each day to remind group member speed up the project making.

As a CFO, I response for budget planning and material punching. My goal is use the least money to buy the material we need.

7.7 Work Breakdown

TABLE 2: WORK DISTRIBUTION TABLE

High-Level Task	Davidson	Kefan	Chao	Rowen	Yufan
Documentation	✓	✓	✓	✓	✓
Documentation editing	✓✓	✓	✓	✓	✓
Electronic circuit design	✓✓			✓	✓
Case construction	✓✓	✓	✓✓	✓	
Structure design	✓	✓✓	✓	✓✓	✓
PCB design	✓✓		✓		
Components research	✓✓	✓	✓	✓	✓
Circuit Testing	✓✓	✓	✓	✓✓	✓✓
Mechanical Testing	✓	✓			
Shopping for parts		✓✓	✓✓	✓	✓✓
Financial record					✓
Video					✓✓

8. Conclusion

Our team has achieved the initially goal of our project. The D-Charger now has been able to fully function. It can generate electricity from hand crank and feed pedal and the solar panel also works well. However, due to the lack of fund and time our cases is little heavy and uncomfortable, compared to our initial idea. To improve the case structure, we can redesign the structure and change the material.

Overall, this course it was difficult but a rewarding experience, where we learn how to work as a team and communicate with others. Also we were able to use knowledge in a practical way, and learn some practical techniques. Most importantly, D-charger project has showed us that we have the capabilities as well as our faults that we can improve. The experience we gained during this project is beneficial to each of us in each our own ways.

Appendix 1: Meeting Minutes

Date of meeting: **September 16, 2015**
Location: Meggie Benston
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 12:00-1:00
Meeting content: Meet to gather some ideas. One is dust-remoter which has high frequency to shake the machine to clean dust. It can also make noise to keep mouse away.
Another idea is following robot which can take something for the host which will involve in embedded system. In additional idea is the device tracker using an app and a website to track the device. One more idea is solar power heating bottle which use solar power to heat water. And auto walk the dog system.

Date of meeting: **September 18, 2015**
Location: Asb cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30-5:00
Meeting content: Getting more idea about project one is multi-function wire. Multi-function wire is a wire have several port that can charge different device with just one wire. It can give great convenience to customer. Another idea is Wifi energy charger. The Wifi's electro wave can contain energy which can charge battery. And auto walk the dog system. Selected the Discovery Technologies as the company name. Some discussion about the logo but it has not been decided yet.

Date of meeting: **September 21, 2015**
Location: Bennett Library
Group member: Davidson Kao, Yufan Wang, Kefan Gao, Rowen Jiang
Time: 10:45am-12:00pm
Meeting content: We get another idea which is Battery pack-use solar panel, it will charge a battery (rechargeable). Battery has wires or ports that be used to power other things. Solar panel can be pinned (clipped) attached to bags or clothes. Another idea is battery charger exercise battery or exercise monitor. The exercise material that can generate electricity. Instead of telling the user how much calorie they used, tell them how much energy they made. This is good because exercise also charges a battery. Getting another idea which is food scale it is a smart kitchen scale which can type in the food which is weight and give the nutrients and calories it contains. Through cooking a meal, the weight can give a full nutrients report for the customer. It is a good idea. Note: Need a database.

Date of meeting: **September 23, 2015**
Location: Asb cafe

Group member: Davidson Kao, Yufan Wang, Kefan Gao, Rowen Jiang
Time:4:30-5:15pm
Meeting content:
We ask Andrew about our ideas and Andrew deny the smart scale idea and he thinks the Battery pack and following robot is a good idea. So we will use Battery pack as our project.
We also work on company detail. We also make proposal planning and we divide the proposal work to each person. Davidson will work on project plan. Yufan will response for component, cost and market research. Kefan will response for background and introduction. James will work on risk and benefits. Rowen will write the conclusion and reference. We finally decide use solar panel, rechargeable lighter as our main components.

Date of meeting: **September 25, 2015**
Location: Asb cafe
Group member: Davidson Kao, Yufan Wang, Kefan Gao, Rowen Jiang
Time: 4:10-5:00
Meeting content
Team organization: funding (Terry)
Project overview and project planning (Davidson) +letter
System overview (James)
Background and summary (Kefan)
Research about battery (Rowen)
Camping/ army/ encountering emergency situation
Introduction: project detail: product
Theory: convert solar power into electric power. Rowen organize. Next meeting Saturday 20:00

Date of meeting: **September 26, 2015**
Location: N/A
Group member: Davidson Kao, Yufan Wang, Kefan Gao, Rowen Jiang
Time: 8:15pm-11:00pm
Meeting content: skype meet together work on proposal

Date of meeting: **September 28, 2015**
Location: Bennett Library
Group member: Davidson Kao, Yufan Wang, Kefan Gao, Rowen Jiang
Time: 4:30pm-7:00pm
Meeting content: work on proposal and correct grammar mistake.

Date of meeting: **October 5, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang

Time: 4:20 ~ 4:50
Meeting content:

1. Decided the exact day that we prepare to go to electronics store.
2. Meet at SFU on Oct 6th at 11:30am to look for Prof.
3. Component that we need to order: generator, solar panel, battery.

Date of meeting: **October 7, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:20 ~ 4:50
Meeting content:

1. Setup time for next meeting (Friday 10:30 am)
2. Buy materials for project on Friday (Battery, generator, solar panel)
3. Starting for Functional Spec.

Date of meeting: **October 9, 2015**
Location: LEE Electronics
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 10:00 ~ 2:00
Meeting content:

1. Working on functional Spec. Assign work to each member
2. We went to the electric recycle to find a rechargeable battery or other components that we can use.

Date of meeting: **October 12, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 10:00 ~ 2:00
Meeting content:

1. We decided to use the hand crank flashlight generator as our generator

Date of meeting: **October 14, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 5:30
Meeting content:

1. Do some research about household AC port standard
2. Discuss about Safety Requirement
3. Skype meet at 10:00am on coming Friday
4. Talk about the process detail

Date of meeting: **October 16, 2015**
Location: N/A
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: N/A
Meeting content:

1. Try to use sketch up to design the hand cranking case
2. Decide the position of the generator
3. We need to calculate the efficiency of the solar panel

Date of meeting: **October 19, 2015**
Location: Lab 4
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:30
Meeting content:

1. Functional Spec. final discussion
    a. add more on the conclusion
    b. change audience for Functional Spec.

2) Discuss content of oral presentation
    a. assign different part to team members

Date of meeting: **October 21, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 5:30
Meeting content:
Assign works

1. Kefan: Sketchup and structure design
2. James and Davidson: PCB software learning
3. Rowan and Terry: design circuit

Date of meeting: **October 23, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Chuan Jiang
Time: 4:30 ~ 5:30
Meeting content:
Discuss for the structure design. Share each one's idea and improve the structure design.

Date of meeting: **October 26, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Chuan Jiang
Time: 4:30 ~ 5:30

Meeting content:
We finished design the circuit, Chuan and Yufan will start drawing the circuit and calculate the size of components. The circuit will be fine. We find a PCB producer which can make our PCB in a week.

Date of meeting: **October 28, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 5:30
Meeting content:
Discuss some learning material about the software 'eagle' to design PCB board.
Discuss the basic design for structure, we want to use the base to fit shoe.

Date of meeting: **November 2, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:30
Meeting content:
Discuss whether we use PCB or not. We need a PCB to combine our components. However, there are some devices like voltage regulator that doesn't need to be on the PCB board.

Date of meeting: **November 4, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:30
Meeting content:
We think to reduce the total size of our product, PCB is very important, the circuit might be more complex than we thought. We can leave the connect hole on the board for other electronics devices.

Date of meeting: **November 6, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:30
Meeting content:
We find the theoretical AC-DC circuit for our PCB, but we find that it is not for a 3 phase motor, we need to change a bit about the circuit to let it can work for the 3 phase motor.
We also need to calculate and decide the data about the diode and capacitor that we will use.

Date of meeting: **November 9, 2015**
Location: ASB cafe

Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:30
Meeting content:
We decided to use batteries as in series, but the output voltage is no longer 5V. Therefore, we need to use a larger output voltage regulator to increase the output voltage from generator in order to charge the battery.

Date of meeting: **November 11, 2015**
location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:30
Meeting content:
We realize we might not have enough time to order PCB borad, so we decided to use breadboard as our backup plan. We test out the voltage of series batteries on breadboard.

Date of meeting: **November 13, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:00pm
Meeting content:
We meeting for ordering PCB board and find some wood material in homedepot junk to build our main body of D-charger - feet pedal case. Moreover, we will test the output voltage for our motor.

Date of meeting: **November 16, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:00pm
Meeting content:
We have built our first feet pedal case. Unfortunately, we disorder the pieces and glue a wrong case. Since we haven't built the entire circuit and we don't know the actual size of the hand crank case. We decided to build circuit and hand crank case.

Date of meeting: **November 18, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:00pm
Meeting content:

1. Talking about the case structure and material
2. Circuit alteration

3. Do research about the USB port and decide to use AILI013 which is 1 PC DC-DC boost converter 3V up to 5V to 9V 2A USB output voltage step-up Module

Date of meeting: **November 20, 2015**
Location: Home Depot/ Asb cafe
Group member: Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang, Davidson Kao
Time: 2:00 ~ 3:00
Meeting content:

1. Decide to the case material which is the medium density Fibreboard
2. discuss the structure of our cases
3. want to use lego as a component to connect between gears

Date of meeting: **November 23, 2015**
Location: Asb cafe
Group member: Chuan Jiang, Davidson Kao, Kefan Gao, Chao Duan, Yufan Wang
Time:4:30 ~ 5:30
Meeting content:

1. Decide to use the DC-DC voltage regulator USB port as the main plan and the USB port with a voltage regulator as a backup plan.
2. Continue and finish the PCB designing for our circuit.

Date of meeting: **November 27, 2015**
Location: ASB café and Lab1
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 10:30 ~ 13:00

1. Meeting content: Test USB and soldering the wire into the USB to measure the output voltage of USB. When Vin = 2~5V, Vout = 5V. When Vin > 5V, Vout = Vin. And there is no back flow for our USB Module.
2. Test solar Panel: Soldering the long wire on solar panel to test the output voltage. Vout (max) = 5.7V Imax= 10mA.
3. PCB pick up at Surrey before 17:00
4. Decide the possible inside case prototype 7.5*4*7cm
5. The ordered components of the diode and etc. will arrive on Monday due to Thanksgiving

Date of meeting: **November 30, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 4:30 ~ 6:00pm
Meeting content:

1. Do soldering on PCB and test the circuit on breadboard tomorrow

Date of meeting: **December 2, 2015**
Location: SFU lab1
Group member: Davidson Kao, Chao Duan, Yufan Wang, Chuan Jiang
Time: 1:00 ~ 7:00
Meeting content:

1. soldering wire on solar panel.
2. test generator, battery and solar panel on breadboard
3. continue solder components on PCB board

Date of meeting: **December 4, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Chuan Jiang
Time: 10:00 ~ 7:00
Meeting content:

1. set up for next meeting time, due to the final, the project well process a little bit slow.
2. discuss the following plan for the project

Date of meeting: **December 7, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Chuan Jiang
Time: 10:00 ~ 7:00
Meeting content:

1. buying wood for hand crank and feet pedal case
2. drawing shape on the wood board.

Date of meeting: **December 9, 2015**
Location: ASB cafe
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 10:00 ~ 7:00
Meeting content:

1. Working on the outer case. Sawing wood board and make pieces into box.
2. Using tube to connect feed pedal gears and hand crank gears.
3. Soldering a backup PCB board.

Date of meeting: **December 11, 2015**
Location: Associated Plastic & Supply and SFU lab1
Group member: Davidson Kao, Kefan Gao
Time: 2:00 am - 4:00pm
Meeting content:

1. Order plastic case at Associated Plastic & Supply
2. Make a wooden case for backup use

Date of meeting: **December 14, 2015**
Location: SFU lab1
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 10:00 am - 8:00pm
Meeting content:

1. Working on the connection between hand crank gears and feet pedal gears
2. structure the hand crank case
3. find problem on the connection, ask help from TA and send email to Andrew for extension.
4. get some ideas for solving the connection problem

- Use other gears instead of the original to reduce the force on the feed pedal gears.
- Adjust tube to make sure the connection is not shank while is pressing the feet pedal.

Date of meeting: **December 15, 2015**
Location: SFU lab1
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 1:00 am - 7:00pm
Meeting content:

1. Buy more hand pressing flashlight for backup use.
2. Buy more screw to stable the tube between gears
3. stable the feet pedal case

Date of meeting: **December 16, 2015**
Location: SFU lab1
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 1:00 am - 6:00pm
Meeting content:
use our backup plan to use second gears as the connect gear. However, after we finish and test it, the feet pedal gears still cannot provide enough force to make the hand crank gears move. Ask TA for help but the TA is not available today. Hope can get some help tomorrow.

Date of meeting: **December 17, 2015**
Location: SFU lab1
Group member: Davidson Kao, Chao Duan, Yufan Wang, Kefan Gao, Chuan Jiang
Time: 1:00 am - 6:00pm
Meeting content:
We are here to work on our post-mortem and wait for TA's help. TA will be available after 9pm.